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January 3, 2005

BY ELECTRONIC MAIL
Patrick Morris
Senior Water Quality Control Engineer
California Regional Water Quality Control Board
Central Valley Region
11020 Sun Center Drive #200
Rancho Cordova, CA 95670-6114

Dear Mr. Morris:

I am writing in response to your request of December 1, 2004 to provide a peer review of the Amendment to the Water Quality Control Plan for the Sacramento River Basins (Basin Plan) for the Control of Mercury in Cache Creek, Bear Creek, Sulphur Creek, and Harley Gulch Staff Report. I have reviewed the documents provided as well as other materials related to the project and have evaluated the scientific basis for the proposed actions. My comments are listed below:

Comment #1: General Impressions. The authors of the TMDL and Staff Report have made a great deal of progress in integrating the available data on the Cache Creek watershed and developing a plan for controlling mercury concentrations in fish. Overall, I believe that the recommendations of the report are scientifically sound and represent a reasonable first step in improving water quality in the Cache Creek watershed. The authors of the staff report have done an excellent job in presenting their basis for deriving standards and setting remedial goals for the system. I am not familiar enough with the nature of the abandoned mines and the watershed to assess the likelihood that the proposed remedial efforts will control Hg releases in a cost-effective manner.

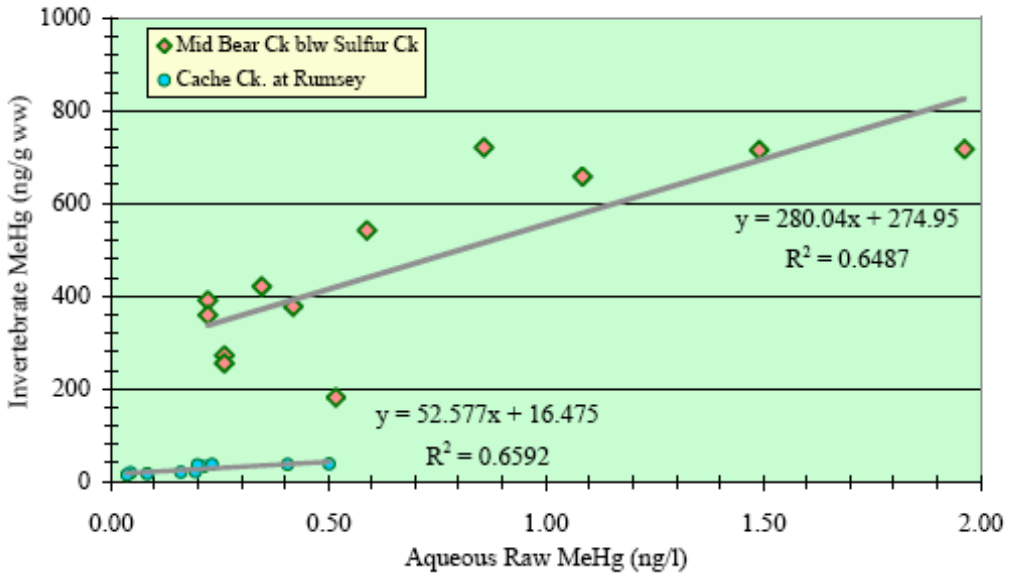
The authors are aware that the system is very complicated and that changes in the plan may be needed as more data are collected. In recognition of the potential to improve the scientific understanding of the system and to adapt the TMDL as this information becomes available, it may be worthwhile to include some additional parameters in the monitoring plan. Examples of possible areas where further data collection might help in the adaptive management process are discussed below.

Comment #2: Linkage between methylmercury (MeHg) in water and fish. From a scientific standpoint, the linkage between total MeHg in water and fish is one of the most important assumptions in the TMDL. On page 74 of the TMDL a relationship is described between total MeHg (which is referred to as raw MeHg) and MeHg

concentrations in invertebrates. The source of the correlation is a Calfed report by Slotten *et al.* (2004a), which I did not have time to review in detail.

The correlation between total MeHg and invertebrate MeHg covers a wide range of MeHg concentrations. I suspect that the high concentrations in the regression are from highly contaminated sites (e.g., Harley Gulch, Sulfur Creek) while the low concentrations are from the less contaminated sites further downstream. If this is the case, the correlation indicates that highly contaminated sites in the upstream area have higher concentrations of MeHg in both water and invertebrates than the less contaminated sites. However, the pooled data do not provide a quantitative basis for predicting how the invertebrate MeHg concentrations will decrease as total MeHg concentrations decrease at specific sites in the watershed after remediation because the biology and geochemistry of the sites differ. Figure 26 from the report by Slotten *et al.* (2004) provides an example of how the relationship differs between sites:

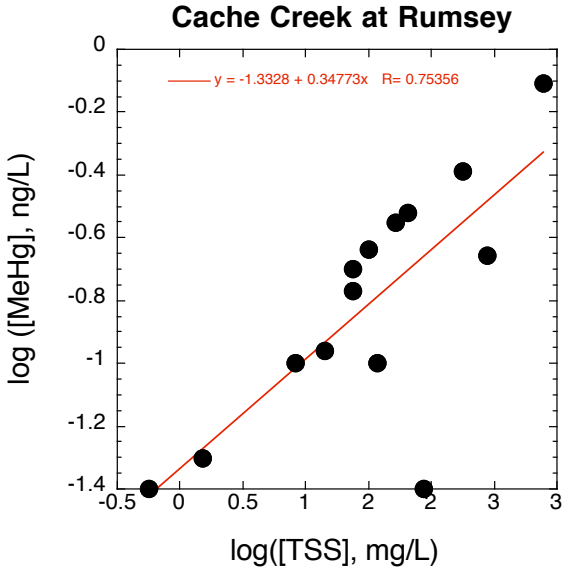
Figure 26.
Comparative site-specific relationships between aqueous raw MeHg and bioindicator organism MeHg at two sites representative of different regimes in the watershed.
(a) mixed predatory invertebrates
(b) small omnivorous fish



It is not clear to me how the relationship derived from the pooled data in the TMDL accounts for these site-specific factors. Although it is attractive to set one criterion for MeHg for the entire watershed (excluding Harley Creek) it may be appropriate to consider the upstream sites close to the MeHg sources separately from the downstream sites.

Comment #3: Dissolved versus Total MeHg. The TMDL mentions that the relationship between total MeHg in water and MeHg in invertebrates was stronger than the relationship between dissolved MeHg and MeHg in invertebrates (p. 73). This assumption appears to be based upon results presented on page 38 of the report by Slotten *et al.* (2004) and is used as a basis for deciding to regulate and monitor total MeHg instead of dissolved MeHg. However, the correlation between filtered MeHg and invertebrate MeHg on p. 38 of the Slotten *et al.* (2004) report was stronger than that of total MeHg (r^2 of 0.76 vs. 0.62). In any case, the fact that a better correlation between total MeHg and invertebrate MeHg is sometimes observed may be due to analytical problems associated with relatively low concentrations of MeHg in the filtered samples. (I am unaware of any scientific data that support the assertion that particle-associated MeHg will be as bioavailable as dissolved MeHg.) From a scientific standpoint, dissolved (i.e., filterable) MeHg may be a more appropriate parameter for the linkage analysis. Use of dissolved MeHg may require a different approach for field sampling that involves field filtration.

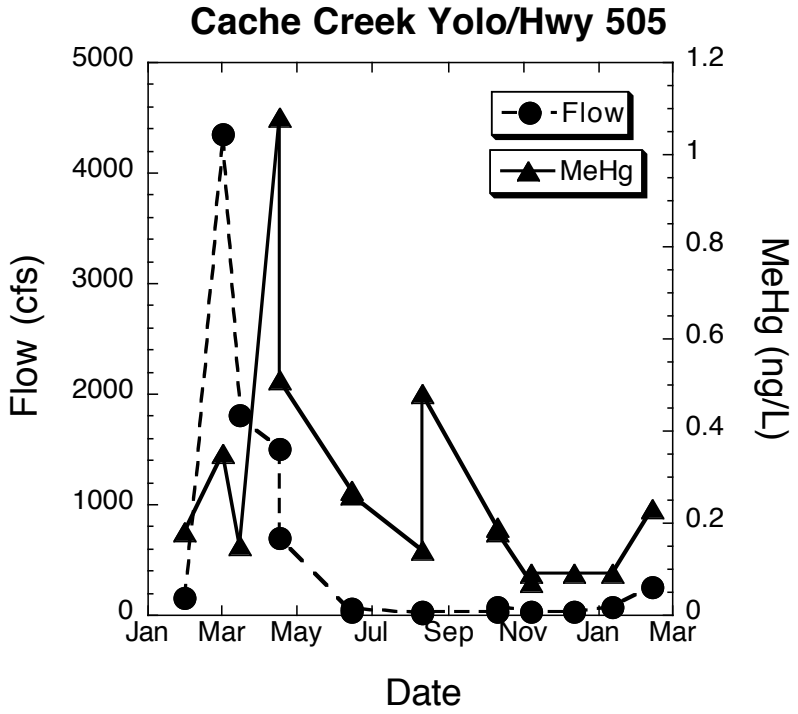
Comment #4: Possible bias associated with the use of Total (raw) MeHg. Total MeHg appears to be correlated to TSS in some sections of Cache Creek (e.g., Cache Creek at Rumsey, see below). Therefore, using total MeHg in the TMDL to monitor for compliance may introduce a bias in the monitoring program: Those sites or sampling dates with elevated TSS may show elevated MeHg relative to samples with low TSS. If particle-associated MeHg is not as bioavailable as dissolved MeHg this may introduce a bias into the TMDL. This is especially problematic if the Regional Board is going to target high flow events in future sampling programs as indicated on page 64 of the Draft Staff Report. Until the relationship between MeHg and invertebrate Hg concentrations are understood, it may be prudent to monitor both total and dissolved MeHg. At a minimum, the RWQCB should pay careful attention to interpretation of data from samples with elevated TSS.



Comment #5: MeHg Budgets. Budgets for MeHg and total Hg are presented in the TMDL report. The MeHg budget is calculated by multiplying the average MeHg concentration at each site by the annual flow while the total Hg budget uses a relationship between TSS and total Hg to adjust loads for particle-associated Hg. On page 40, the TMDL states,

> *"Regressions were run at all sites to ascertain whether there were statistically significant relationships between flow and aqueous methylmercury concentration. Significant relationships were not found for any location."*

This statement seems to imply that little of the MeHg was associated with particles or that as TSS increased during high flow events, dissolved MeHg concentrations decreased due to dilution. From a scientific standpoint, I am uncomfortable with the idea of pooling low and high flow data to estimate and annual MeHg budget, especially when the total mass of MeHg discharged by the Creek is dominated by high flow periods. For example, the figure below shows MeHg data and flow data for the section of Cache Creek at Yolo and below highway 505 between 2000 and 2001 (as included in Appendix B). Although there was not a strong correlation between flow and MeHg in these data, MeHg concentrations were higher during the high flow period from January to April 2000: The average and median MeHg concentrations were 0.45 ng/L and 0.35 ng/L during the high flow periods versus 0.19 ng/L and 0.18 ng/L during the low-flow periods. Such differences may have significant impacts on the overall MeHg budgets because most of the mass of MeHg is transported during the high flow periods. I believe that it may be appropriate to recalculate the budgets by considering high and low flow periods separately. Alternatively, it may be appropriate to include measurements of dissolved and total MeHg in future monitoring programs.



Comment #6 Minor editorial comments.
Page 19, Mercury in water and sediment samples: Table 3.3 expresses Hg concentrations to as many as 4 significant figures. I suspect that only 2 significant figures are justified for the analytical methods used. An appropriate number of significant figures should be used throughout the Staff Report.

Page 21: The Staff Report indicates that the CTR water quality criterion will not be met during storm events. I believe that the site-specific standards developed in the linkage analysis will protect wildlife and consumers of fish. However, it is unclear how the failure to achieve the CTR criterion will affect the MUN designation. I realize that there are no situations in which Cache Creek is used directly as a drinking water supply. However, the MUN designation indicates that the water could be used as a municipal supply and I am not sure that the safety of drinking the water during these high flow events is adequately addressed.

Page 28: "methylization hotspots" should read "methylation hotspots"

If you have any questions or comments, please do not hesitate to contact me.

Sincerely,

David L. Sedlak
Professor